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Food & Nutrition Research Briefs

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What Americans Eat—For Better, for Worse

Are Americans making progress in adopting healthier eating habits? Data yet to be released from USDA's 1989-91 Continuing Survey of Food Intakes by Individuals (CSFII) show a mixed bag. The data come from in-person interviews of more than 15,000 men, women and children of all ages who were asked to report all the foods they ate in one day.

Over the past 15 years, Americans have shifted to a lower fat, higher carbohydrate diet. The average fat intake in 1989-91 was 34 percent of total calories—down from 36 percent in a 1987-88 USDA survey and 40 percent in a 1977-78 USDA survey. Even though we're making progress, our diets are still higher in fat than the 30 percent or less recommended by the Dietary Guidelines for Americans, issued by USDA and the Department of Health and Human Services.

Carbohydrates offset the drop in fat. Intake was 49 percent of total calories in 1989-91—up from 47 percent in 1987-88 and 43 percent in 1977-78. Americans ate fewer eggs and drank more low-fat and skim milk in place of whole milk. And we increased our intake of foods containing complex carbohydrates and sugars, such as grain products and non-diet soft drinks.

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Americans ate substantially more cereals and pasta in 1989-91 than even two years earlier. The biggest increase came in mixed foods that are mainly grain—such as pizza, lasagna, burritos, enchiladas and soups. Consumption jumped 24 percent in two years and a whopping 71 percent since the late 1970's. Meanwhile, we cut back on cuts of beef and pork, such as steaks and roasts.

The bad news is that we are not heeding advice to eat more fruits and vegetables—at least five each day. Vegetable consumption has declined since the 1970's, despite mounting evidence that vegetables are a prime source of compounds that appear to promote health, as well as an excellent source of many vitamins.

Fruit consumption increased only about 10 percent since the two earlier surveys, and the increase was spotty. Only about half—53 percent—of the survey respondents ate fruit or drank fruit juice in a given day. The percentage was even

lower for some groups, especially teens and adults under age 50. And fruit intake by low-income individuals was 25 percent below that of middle- and high-income individuals.

Another troublesome finding is that Americans were drinking 12 percent less fluid milk in 1989-91 compared to the late 1970's. And the percentage of low-income individuals drinking low-fat milk was nearly half that of high-income individuals. During the same period, our intake of carbonated soft drinks soared 72 percent. We also drank 24 percent more fruit juices—both citrus and non-citrus—and 30 percent more ades.

The average sodium intake from foods and beverages, excluding what came from the salt shaker, was nearly 600 milligrams above the 2,400-mg recommended limit. And cholesterol intake for males age 12 to 69 exceeded the 300-mg limit recommended by several health groups.

As for other nutrients, most groups met or exceeded the Recommended Dietary Allowance for protein, vitamin A, vitamin C, vitamin B₁₂, thiamin, riboflavin, niacin, folate, phosphorus and iron. The exception for iron was children between age 1 and 2 and women age 12 and 49. By contrast, the population in general and many age and gender groups fell below the RDA for vitamin E and vitamin B₆, calcium, magnesium and zinc. Some type of vitamin and mineral supplement was used by 47 percent of women age 20 and over and by 32 percent of men in a given day. Multivitamins were most commonly used.

In addition to tracking changes in food choices by Americans, the survey helps officials target nutrition education programs to those who need them most and predict the demand for agricultural products, ensuring the availability of foods Americans want to eat. *To receive a copy of the report—"Food and Nutrient Intakes by Individuals, 1 Day, 1989-91"—when it is published, write to Katherine S. Tippet, 4700 River Road, ARS, Unit 83, Riverdale, MD 20737. The next nationwide survey is already in its second year. Preliminary findings from 1994 will be released next year.*

Colon Inspection—No More Ouch

The uncomfortable procedure now used to remove cells from the colon in order to detect cancer or look for pre-cancerous conditions may soon go the way of the dinosaur. ARS and Johns Hopkins University researchers have developed a method for isolating viable colon cells from a

fresh stool sample. Not only will the technique allow doctors and researchers to bypass the invasive and expensive colonoscopy, it also will enable a more thorough inspection. Cells isolated from the stool represent conditions in the entire colon rather than a few areas scraped during biopsy. That's because the lining of the colon sheds more than a billion cells every day, most of which are still viable as they pass out through the stool.

The technique uses standard laboratory equipment and costs \$40 to \$50 per sample compared to \$1,000 to \$1,500 for colonoscopy, which must be done in a hospital. When geared up for use by commercial laboratories, the cost will drop even further. And the patient need not lose a day of work. *For more information, contact Padmanabhan P. Nair, (301) 504-8145, Beltsville Human Nutrition Research Center, Beltsville, MD.*

Fates of Fat

Men with high levels of body fat may burn less fat than their slimmer colleagues when exercising, a study of 32 men suggests. The volunteers pedaled through a sequence of increasingly difficult five-minute stints on an exercise bicycle. ARS researchers later computed the number of calories burned—including calories derived from fat. They then calculated the number of calories the men would have burned if each five-minute stint had extended a half hour.

One comparison of two men of average fitness showed that volunteer A would have burned 392 calories, with 153 of those from fat. Volunteer B, who was comparably fit but had more body fat, would have burned 374 calories, with only 81 fat-derived calories. The portly volunteer would have used only half as many fat-derived calories as his lean counterpart.

Longer workouts at a lower heart rate may help males with excess fat boost the number of fat-derived calories that they burn, the scientists suggest. That's because the slower workout will help the chubbier men sustain a reasonable fat-burning rate. The effect of body fat on men's fat-burning rates has only been reported in one other study, done elsewhere with treadmill workouts. *For more information, contact Nancy L. Keim (415) 556-8821, Western Human Nutrition Research Center, San Francisco, CA.*

A woman's food intake during pregnancy may have a lifelong affect on the amount or location of body fat in her adult children. Researchers have reproduced in laboratory rats the obesity that scientists noted in the young adult sons of Dutch mothers who were undernourished during their second trimester of pregnancy—due to severe food rationing in World War II. Because rat pups are born far more underdeveloped than human infants, researchers reasoned that the third week of gestation in rats—which is their last week—is equivalent to the second trimester in humans.

When the pregnant rats were given half the amount of feed they would normally eat during the third week, their offspring were 28 percent fatter after puberty than those whose mothers got normal rations throughout pregnancy.

The researchers also found that if pregnant rats were deprived of food during the first two weeks of gestation and were then allowed to overeat during the third week, the young pups had more body fat in the abdominal area. In people, abdominal fat is linked to increased risk of heart disease and diabetes. These findings, together with observations from the Dutch famine, suggest that big changes in food intake during pregnancy—either up or down—may influence fat patterns in offspring. *For more information, contact Marta L. Fiorotto, (713) 798-7146, Children's Nutrition Research Center, Houston, TX.*

Artery Narrowing and Low Vitamin Levels

Eating plenty of green vegetables, citrus and other foods rich in folate (folic acid) may help keep the arteries open and thus reduce risk of heart disease and stroke. A collaborative study of 1,041 elderly men and women still participating in the original Framingham Heart Study strengthens the evidence that elevated blood levels of homocysteine increase the odds for significant narrowing of the arteries. Folate and vitamins B₆ and B₁₂ are needed to convert homocysteine into useful amino acids and thus hold the key to keeping blood levels in check.

Researchers with the Framingham study assessed the degree of narrowing in the subjects' neck arteries using ultrasound. Then, ARS-funded researchers measured the levels of homocysteine, folate and vitamins B₆ and B₁₂ in the subjects' blood and statistically compared these levels with artery narrowing. Those with the highest homocysteine levels were twice as likely to have significant narrowing—a loss of at least 25 percent of the inner diameter—as those with the lowest levels. Narrowing increased in step with homocysteine levels.

The analysis also showed that insufficient levels of folate and, to a lesser extent, vitamin B₆ contribute to increased risk of artery narrowing. This confirms earlier findings by the same research team showing that high homocysteine was linked to low intakes and blood levels of the B vitamins. *For more information, contact Jacob Selhub, (617) 556-3191 or Paul Jacques, (617) 556-3322, Jean Mayer USDA Human Nutrition Research Center on Aging at Tufts, Boston, MA.*

Trace Element Has Far-Flung Influence

When dietary copper was restricted in pregnant and nursing rats, the pups had retarded development of nerve cells in the part of the brain that governs learning and memory. This part of the brain—called the hippocampus—does not finish maturing until after birth and is therefore especially vulnerable to nutrient deficiencies. Studies have shown that the brain requires copper for normal develop-

ment, but none have specifically asked if copper was important to nerve cell maturation in the hippocampus. Apparently it is, ARS researchers found, based on the number and size of neurons in a section of the hippocampus. The degree of retardation in nerve cell development depended how much the mothers' diets were restricted in copper.

The next question is whether the developing brain can recover by giving weaned pups adequate copper. Such experiments can't be done on humans for ethical reasons. But it might be prudent for pregnant and nursing mothers to include some high-copper foods in their diets, such as whole grains, oysters, liver, nuts (particularly Brazil nuts), seeds, cocoa and chocolate. A majority of Americans consume less than the minimum suggested copper intake, which is 1.5 milligram daily. *For more information, contact Curtiss D. Hunt, (701) 795-8423, Grand Forks Human Nutrition Research Center, Grand Forks, ND.*

Copper deficiency ultimately reduces the ability of body cells to receive signals critical for nerve transmissions, immune response, heart rhythms and other functions that depend on precise coordination and timing. This new finding could explain the wide range of pathologies reported in copper-deficient animals—from heart muscle damage and depressed immune response to neurological problems. Researchers studied blood platelets from copper-deficient rats because platelets, like immune cells and nerve cells, await a chemical signal from outside before they respond—to help form a blood clot, for instance.

What they found was a 36 percent drop in a substance that is critical for transmitting outside signals to the cell's interior. That's because the cell had commandeered this substance—called GTP—to help supply the power it needed to stay alive. Normally, cells produce energy by a process that requires a copper-containing enzyme to make it go. But with so little copper available, they compensated by switching to GTP—a production method that doesn't require a copper-containing enzyme—just as an electrical power plant may switch to coal when natural gas is in short supply. In so doing, however, the cells compromise their ability to receive incoming signals that prompt them when and how to respond and when to stop responding. *For more information, contact W. Thomas Johnson, (701) 795-8411, Grand Fork Human Nutrition Research Center, Grand Forks, ND.*

Alcohol, Vitamin C and Blood Cholesterol

One to two alcoholic drinks daily had a positive effect on both "good" and "bad" blood cholesterol levels in young women. The beneficial HDL cholesterol increased an average of 10 percent, while the artery-clogging LDL cholesterol dropped eight percent when the women were getting the equivalent of two six-ounce glasses of wine or two ounces of spirits daily. Total cholesterol did not change, however.

About 44 percent of American women drink alcoholic beverages at least once a month, so researchers with ARS and the National Cancer Institute wanted to assess the effects of alcohol as part of the diet in women ages 21 to 40. This age group is rarely studied because blood lipids and other biochemical markers tend to fluctuate with changes in female hormones throughout the menstrual cycle. Researchers reduced this variable by sampling blood when each woman's female hormones were at their lowest levels. And to ensure that any changes in blood lipids were due to alcohol intake and not to dietary habits, the women were given the same diet—typical U.S. fare—with the same amount of fat—36 percent of calories—for all six months of the study. The findings support a body of evidence linking alcohol consumption to higher HDL levels in men and women.

However, as reported earlier, daily consumption increased levels of estrogen hormones from seven to 32 percent during the women's cycles. Estrogen hormones are thought to play a role in breast cancer, although how they do so has remained elusive. And moderate alcohol consumption has been linked to breast cancer. The results suggest this link may be through alcohol's effects on estrogen. *For more information, contact Beverly Clevidence, (301) 504-8367, Beltsville Human Nutrition Research Center, Beltsville, MD.*

Does extra vitamin C raise HDL cholesterol—the kind that helps prevent cholesterol buildup in the arteries? The answer, according to an eight-month study of 138 men and women, is yes and no. Those volunteers who began the study with vitamin C blood levels under one milligram per deciliter (mg/dL) benefitted from taking a one-gram vitamin C supplement each day. HDL increased an average seven percent, dropping the ratio of HDL to total cholesterol by eight percent. But the supplements had no effect in two-thirds of the volunteers—those who began with vitamin C levels at or above one mg/dL. The findings explain why other studies on this question have produced mixed results; the outcome depends on the subjects' baseline vitamin C levels.

Researchers emphasize that it doesn't take supplements to raise plasma levels above the one mg/dL mark. Eating five servings of fruits and vegetables a day will easily do it. And these foods provide other protective substances besides antioxidants that aren't in supplements. Even three to four servings of the top vitamin C sources would do. These include citrus, broccoli, cauliflower, strawberries, papaya, potatoes and many dark, leafy greens. *For more information, contact Paul Jacques, (617) 556-3322, Jean Mayer USDA Human Nutrition Research Center on Aging at Tufts, Boston, MA.*

Your Cheated Heart

The heart may be as vulnerable to damage from oxygen free radicals as it is to emotional hurt, according to a study of rats. ARS researchers wanted to know why copper deficiency is so hard on the heart muscle of test animals but not

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on other organs. They suspected it may be due to differences in antioxidant enzymes among the organs. These enzymes protect cells from oxygen free radicals—generated by normal metabolism. At least two of these enzymes require copper to function, so copper deficiency could leave cells more vulnerable to oxidative damage.

What the researchers found was lower levels of four antioxidant enzymes—not just the copper-containing enzymes—in the rats' hearts compared to their livers. And they found this difference in control animals as well as copper-deficient animals. Enzyme activity ranged from 1.5 to 50 times lower in heart muscle cells in all the animals. In fact, the enzyme that was 50 times lower—catalase—requires iron rather than copper to function. This suggests that the vulnerability of the heart to copper deficiency and possibly to other conditions that increase oxidative stress is due to a relatively weak antioxidant defense system. *For more information, contact Jack T. Saari, (701) 795-8499, Grand Forks Human Nutrition Research Center, Grand Forks, ND.*

Beefing Up Food Safety

Poorly fed cattle are at greater risk of carrying dangerous levels of the bacterium that killed four children and sickened hundreds of people who ate undercooked hamburgers on the West Coast two years ago. That's the finding of ARS researchers looking at cost-effective ways to reduce meat animal exposure to the deadly bacteria—*E. coli* 0157:H7. They say cattle subjected to dietary stress during transport and marketing represent a high-risk group. Fasting animals have an imbalance of rumen microorganisms, which normally keep the bad bugs at bay.

The scientists' recommendation: Producers and marketers should feed pre-slaughter animals regularly to maintain the normal balance of rumen microbes and suppress pathogenic bacteria like *E. coli* 0157:H7. *For more information, contact Mark Rasmussen or Brad Bosworth, (515) 239-8242, Physiopathology Research, Ames, IA.*

An easy-to-use test kit for fruits and vegetables can verify that residues of a fungicide, thiabendazole, are at or below safe levels. The fungicide protects potatoes, apples, bananas, lemons, oranges and other produce from microorganisms that cause molds and rots. ARS researchers and colleagues from Millipore/ImmunoSystems, Bedford, MA, developed the test kit that Millipore will begin selling this spring. It will simplify testing by regulatory agencies, food processors or retailers who run their own safety checks of produce. Growers, too, could use the test to ensure that thiabendazole levels in dips or sprays are adequate to safeguard the harvested crop without leaving excess residue. The test takes about four hours—faster than other methods for detecting the chemical. *For more information, contact David L. Brandon, (510) 559-5783, Food Safety and Health Research, Albany, CA.*

Cukes With Carotene for the Third World

For the first time, bright-orange cucumbers loaded with beta carotene could be the end-product of cucumber breeding research. An ARS scientist developed new cukes that can be bred into commercial varieties. Fruit from two breeding stocks of cucumbers contain from one to 25 parts per million of carotene—compared to cantaloupe with 15 to 20 ppm and carrots with 75 to 150 ppm.

If preserved, these cucumbers taste like any other pickle, but retain beta carotene that the body converts to vitamin A. Vitamin A is necessary for normal vision, bone growth and tooth development. Unlike carrots, cucumbers grow well in hot, humid climates of developing countries where many children suffer vitamin A deficiencies. *For more information, contact Philipp W. Simon, (608) 262-1248, Vegetable Crops Research Laboratory, Madison, WI.*

Back to Mother Nature to Reduce Spoilage

ARS and Morse Enterprises, Ltd., of Miami, FL, are collaborating to evaluate and enhance natural citrus proteins that help plants ward off insects, nematodes and microbial pathogens. Using natural plant compounds that also provide nutrients will reduce pesticide use and costs. By enhancing defensive systems already present in plants, scientists hope to reduce losses before and after harvest. The cooperative effort will investigate methods to apply the compounds, which may be an alternative to fumigation with methyl bromide. The proteins, discovered in citrus by ARS scientists, may also work in other crops. *For more information, the ARS contact is Richard T. Mayer, (407) 897-7304, U.S. Horticultural Research Laboratory, Orlando, FL.*

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